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ABSTRACT

A discussion of whether teaching is a science, an art, or both, and the extent to which it is either and why, is presented in this paper. Teaching-as-a-science (TAS) and teaching-as-an-art (TAA) are not specific teaching methods but rather two different ways to find teaching methods. Whether students learn as a result of the teacher's scientific or artistic attitude rather than how students learn is the focus of the discussion. The paper offers analyses of the following: the terms "art" and "science" in language; whether TAA and TAS are desirable; definitions of teaching; definitions of art and science; TAA and TAS compared; the logic of science; the role of rules (rules make science, but rules may be subject to creative redesign by the artist); and the politics of TAA and TAS. Whether teaching is an art or a science depends on the definition of teaching adopted and how the goals of teaching are perceived. (SM)

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# IS TEACHING A SCIENCE OR AN ART?

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Paper presented at the Annual Conference of the Midwest
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# IS TEACHING A SCIENCE OR AN ART?

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## I. INTRODUCTION

Is teaching a science or an art, or both? If both, to what extent is it either, and why should it be even if it can be? In the paper we shall attempt to throw light on these questions by, first, discussing the meaning of the terms "art" and "science," including the difficulties involved in such discussion. Knowing more about the meaning of the terms "art" and "science" may help us to better understand what it means to teach as if teaching were either an art or a science. And second, we throw more light on the second question by building those analytical tools, such as, TAA and TAS (explained below), that will help us to understand not only whether teaching is an art or science, but if it is both, then exactly in what amount or degree is it either, or at least can be.

In the paper, we refer to that type of teaching which assumes that teaching is a science as "teaching-as-a-science," or TAS for short; and that type which assumes that teaching is an art, as "teaching-as-a-an-art," or TAA for short. TAS and TAA are not themselves specific teaching methods, but two different "methods" for finding teaching methods. Metaphysically speaking, they are "meta-methods" of teaching, rather than specific teaching techniques. Although they are not fully developed educational philosophies, they are based on certain underlying philosophical assumptions[1]. For example, undergirding TAA may be a variety of different philosophical views regarding the nature or purpose of art, and therefore also of TAA. In any event, TAA and TAS are not independently existing ideas in the Platonic sense, but instead "makeshift" constructs designed for the purpose of helping us to understand the differences between the two types of teaching[2]. Finally, it may be noted that as meta-methods of teaching, TAA and TAS require that we see even formal schooling from a distance. Theirs is the educational landscape that extends well beyond the classroom, since the classroom itself is no more than just another teaching method.

Although closely related, the attitude that a teacher adopts toward himself as the teaching agent is not identical to that which he adopts toward his students as learners. By TAA and TAS we mean the attitude that a teacher adopts toward his teaching, than toward his students as learners, or of his students toward their learning. A teacher's attitude or practice toward his teaching is also different from the attitude or practice that students may adopt toward their teacher. As a result, it is not inconceivable that a teacher use a scientific curriculum under TAA, or an artistic curriculum under TAS. For example, a teacher may hold the view, as did John Dewey, that students should learn through the scientific method, but consider his own teaching more his creatively designed art, than his empirically pretested science[3]. For example, he may consider a

scientific curriculum "aesthetically appealing." Alternatively, a teacher may require that his students engage in artistic activities precisely because it may have been shown in a scientific experiment, hypothetically conceived here for illustration purposes, that students learn more or better by engaging in such activities. In other words, a teacher may reject science in the curriculum because of his commitment to science in his teaching. Again, what is important here for our purposes is not how students learn, including their curriculum or teaching methods, since they may learn artistically or scientifically under either TAA or TAS, but whether how they learn is the result of their teacher's either artistic or scientific attitude.

## II. METHOD IN THE PAPER

Our paper is built from the ground up, as opposed to assuming the truth or validity of any one theory or definition of art or science, and building it deductively from the top down. The closest we come to examining existing theories is in our hypothetical analysis of what teaching might be like were art or science defined according to this or that pre-existing theory of art or science.

## III. THE TERMS "ART" AND "SCIENCE" IN LANGUAGE

Are art and science different? Are there certain characteristics, ideas, or activities associated with either one which, taken together, may show art to be either like or unlike science? If the two, art and science, are <u>not</u> different, then it makes no sense that we should be asking whether teaching is a science or an art: art and science are the same, and therefore so are TAS and TAA. As such, it wouldn't really matter whether teaching is practiced as either an art or a science, since the two types of teaching practice would be the same, but that teaching as an art or a science should be practiced at all (as opposed, for example, to teaching being practiced as neither art nor science).

If art is not different from science, then it makes no sense that we should have two different terms in our language to describe essentially the same thing. Unless we have been wrong all along in having these terms, or at least in how we have been using them, art and science <u>are</u> different, and, therefore, so are teaching as an art and teaching as a science. On the other hand, we should also note that historically man has changed the meanings of terms in his language several times, which also explains how languages have evolved over time to better reflect man's understanding of the world[4]. This means that popular linguistic usage or understanding of the meaning of different terms may not be the best or only means of finding out what different terms mean, or, in our case, of finding out whether "art" and "science" are truly different. In any event, we submit that unless all science is art, or all art science, a point to which we shall return again in the paper, there must be certain underlying principles or practices in science which we can't reject without at the same time becoming unscientific, and the same may be said regarding art. If that is so, then the same may be said about TAA and TAS as was said about their corresponding artistic and scientific "contents." In the paper we shall attempt to discover those underlying artistic or scientific principles in teaching that make TAA and TAS at least possible, and possibly desirable.

## IV. ARE TAA OR TAS DESIRABLE?

Since what teaching should be is not the same as what it can be, we may find that at least some of the things that teaching can be, be they either art or science, are undesirable. This issue of "desirability" opens a whole new pandora's box of underlying reasons for choosing this rather than that, for example, a specific mission statement, or, more broadly, an existential view of teaching, rather than, say, a Marxist view. In the paper we neither defend any specific view of teaching, nor the underlying ethical theory that may give such view its larger meaning, but instead examine teaching hypothetically. By "hypothetically" here we mean that we assume a certain view of teaching, and then ask what might be the significance of such view for TAA or TAS.

Suffice it to give here an example of the relevance of ethics to our view of TAS and TAA. Thus on the basis of a situational view of desirability, that is, on the basis of the view that what is desirable is what is considered by the society at that time and place to be desirable, there are certain types of teaching which a society may consider undesirable even if it could be shown that they are at least possible. For example, in a culture that does not value science, as the Middle Ages in Europe did not, no matter how scientific teaching may be shown to be, or perhaps because of it, such teaching will remain undesirable[5]. But even if the majority of the people in a society, or their representative institutions consider certain things, say science, to be undesirable, that doesn't mean that everyone in that society does, as there may be certain individuals whose view of what is desirable is diametrically opposed to social views at large. As representatives of alternative ideas, such individuals may be seen as a threat by those whose ideas and character structure have been shaped by an altogether different view of the world[6]. Finally, we may disagree not only with how other people or the society as a whole come to evaluate the desirability of this or that (for example, of TAS or TAA), but also, and more fundamentally, with their underlying "definition of definition," that is, their meta-definitional metaphysics (or, as we refer to in the paper, their "definitiology").

We begin our paper by defining the terms "teaching," "art," and "science," and the constructs TAS and TAA, below.

## V. DEFINITION OF TEACHING

Trying to define teaching may be no less difficult than trying to define anything. We decided to lay open some of the problems associated with definitions by examining in some detail our preliminary thinking process in defining teaching here, as we believe that similar problems arise in defining the terms art and science, and, by extension, TAA and TAS.

Since teaching signifies a method of conveying information, its precise definition may depend as much on which larger theory of teaching one is willing to adopt, as on what are the ultimate educational goals which teaching is designed to serve. Since there are numerous theories of teaching, or at least potential theories that may be extrapolated from larger systems of thought in the various social and humanistic disciplines, there are at least as many different definitions of what teaching is, or at least of what teaching should be[7]. For example, in the field of philosophy of education alone, definitions of

teaching may vary from the existentialist view of teaching as an enabling exercise, to the Platonist view of teaching as recollection, to the Deweyan view of teaching as facilitating[8]. If one is unaware of all these theories, or of ways of extrapolating different definitions of teaching from them, he may identify teaching with only that type of teaching which he has himself seen or experienced in school; or, if dissatisfied with such teaching, with what teaching he has imagined is most appropriate for the fulfillment of certain educational goals[9].

On the other hand, if one were to re-phrase the question to mean not what teaching ought to be, but more precisely what teaching "really" is, then since teaching is not a thing that can be touched, and therefore shown to be this or that in a certain tangible or "real" form, the next best thing might be either to question whether there is such a thing as "real" teaching, or to take a survey to see what others think teaching really is. But again, simply because the majority of the people in a certain society or situation, or its representative legal or political institutions think that teaching is such and so, doesn't necessarily mean that teaching really is that, since it might have meant something else to the same society in the past, or to other societies elsewhere. It follows that what definition of teaching we adopt, we could neither justify on the basis of wider social practices or beliefs, as we may be assuming precisely that which we wish to define; nor on the basis of larger philosophical systems, as we must also show what reason we have for adopting them, and so on, ad infinitum.

If teaching is possible to define ex cathedra, it might be possible that we baptise it with a meaning that we can commonly agree on; or, if that is impossible due to certain obvious communication obstacles among the different users of the term "teaching," to define teaching a priori, assuming that such definition is clearly qualified as such by its author, or intended at best as a personal dictionary term of his own choosing[10]. It is in this last sense that we decided to define teaching to mean the conveyance of skills or information at the elementary and secondary grade levels. We have intentionally left our definition rather simple and open-ended, as we believe that circumscribing it further will neither add to its power to organize our thoughts, nor leave room for the possible logical re-adjustments that our inquiry into the nature of TAA and TAS may later require.

## VI. DEFINITIONS OF ART AND SCIENCE

Since both art and science are human activities, they share at least in the fact that they are man-made and controlled, as opposed to being controlled by, say, nature, chance, God, or other living organisms. Consequently, if there are any differences between the two, and by extension between TAA and TAS, they can't be because of what man does as man, since they are more alike in that respect than unlike, but because of how man perceives the qualities of his scientific and artistic activities, including their methods, goals, and related scientific and artistic attitudes, to differ. In other words, if art and science are different, they may be more different in degree, than they are different in kind. This may explain why it is often difficult to distinguish between art and science in human activities, including teaching, as such activities are usually perceived as including a little bit of both[11]. Of course whether this is the case, and if so, whether we are justified in calling something either "art" or "science" if

it is neither by itself alone, depends, as mentioned earlier in the paper, or our chosen definitiology.

For our purposes here, suffice it to mention that where science represents man's attempt to understand the world, and therefore is not much different in that respect than other attempts by man to understand, art may be seen as man's attempt to help the world to understand[12]. In his attempt to understand the world, man developed methods of empirical observation of existing facts, with all the disbeliefs or "doubts" for unobservable "facts" that such methods entail. In the process of trying to understand the world, man also developed what is now known as the "scientific method," or what amounts to several rather similar scientific "dialects." This doesn't necessarily mean that he has allowed his method to cloud his understanding, but that this is how he thinks he can understand the world to the best of his ability at this time in his history. Furthermore, if as a result of the technological revolution scientists are more intent today on finding what works, in what is also known as "applied science," that doesn't necessarily make science any more the handmaiden of technological control, or the cause of technological problems, than architecture is the cause of poorly built buildings, or, for that matter, philosophy of bad theorizing. Consequently, it seems unfair that we should blame science for the problems that technology may have brought about, as it is not science itself that caused us all these problems, but how we used it[13].

Finally, it may be pointed out that unlike those who blame science for what is essentially man's failure to use it "better," there are also those, including the philosophers of the enlightenment, who saw science as liberating mankind from superstition, or from the political unfreedoms that such alleged superstition allowed the dominant institutions during the Middle Ages to exercise[14]. Thus quite differently from those who see science as taking away man's freedom, they saw it as an opportunity for man to exercise it by relying on his own senses, including his common sense. This is, incidentally, also John Dewey's argument for the scientific method in education, as he saw it as an opportunity for our students to use it to solve problems, and thus also to build the kind of character or "habit" that is necessary for the survival of democratic institutions[15].

Ironically in this regard, Dewey did not consider teaching itself a science, but a combination of art and science, and if forced to make a choice between the two, more like an art than a science[16]. As he put it, "If there were an opposition between science and art, I should be compelled to side with those that assert that education is an art."[17] While he advocated the scientific method for our students, hoping that eventually they internalize it, he did not think that teachers themselves should practice it in deciding how to teach. Putting the issue of whether teaching is a science or not temporarily aside, we may note here regarding Dewey that students may be getting contradictory messages from teachers who don't practice what they preach, and therefore in effect come to view even the scientific method with cynicism.

By contrast to science, which may be seen as man's attempt to understand what is outside, in the world around him, and thus to bring what is outside "in," art may be seen as his attempt to bring what is inside, "out." This may explain why art is usually seen as a "creative activity," as it allows the artist to re-

create outside himself that which he feels inside, in his heart, or thinks about or imagines in his mind. While art may be seen as an opportunity to express one's inner feelings or ideas for everyone to see on canvas, read in a story, or hear in a musical composition, science may be seen as a method that man has developed to help him "assimilate" in his mind the world outside. This may explain why artists often portray something that exists as they would like it to be, as did a Rembrandt, or, more clearly, a Salvador Dali, while scientists make an effort to portray it "objectively" as-is. It may also explain why artists often read into nature certain images that may not be there, while scientists could not possibly confuse a tree that looks like a person for the person without also distorting, thus in effect "destroying," scientific objectivity. Finally, I refer to the creation of artifacts as the "objectification" of personal feeling, since the artifact gives personal feeling a form which everyone can objectively see. Alternatively, I refer to scientific understanding as the "subjectification" of reality, since through the techniques of observation that the scientist employs the world "enters" inside his understanding.

Although the "reality" which the artist portrays may be more "real" than scientific reality, as it must be at least to the artist, it is nevertheless more subjective than science. This doesn't mean that the scientist has no imagination or will of his own, as he is as human as the artist, and therefore no less liable to re-interpreting, or even "mis-interpreting" the world. What it means is that where the artist is given free rein to reinterpret the world, the scientist makes an effort to describe it objectively. This may be seen from the work of artists who must work as scientists. For example, artists who are hired by scientists for designing scientific illustrations, for example, the illustrations in a medical encyclopedia, are not allowed the freedom to recreate reality <u>as artists</u>, that is, as it can help them express a new vision or feeling, but must recreate it as scientists, that is, as true to what is commonly observable as possible.

If there is art in science, it is re-directed to serve science, and therefore becomes in effect "scientific." The same may be said about the role of science in art: it is re-directed to serve art, and therefore in effect becomes "artistic." For example, an artist may use the latest scientific findings to better express his new vision of the world, as do, for example, filmmakers. If, as Dewey claimed, there is no opposition between art and science, it doesn't mean that the two are logically identical or "coextensive." Consequently, there is no reason why TAA and TAS should be, or that they are so hopelessly opposed that there can be no science under TAA, or no art under TAS. In fact, as we have seen in some earlier examples, it is not inconceivable that a teacher adopt scientific activities for his students under TAA, or artistic activities under TAS.

Finally, another way to compare art with science may be to examine how artists and scientists use symbols. Thus although both use symbols to represent things or ideas, artists use them to represent their inner feelings, as a painter might by using a certain line or color to express his anger; while scientists use them to help them represent the world <u>without</u> feeling, "objectively" as one might say, as a chemist might by assigning certain widely agreed upon symbols to certain observable phenomena[18].

VII. TAA AND TAS COMPARED

It follows from our discussion of art and science, above, that under TAA teaching in no less an artifact created primarily by the teacher-as-artist than any other so-called "work of art." Consequently, teachers are free to rearrange what they know or possess to express objectively their inner feelings or ideas about teaching. Thus a teacher-artist may use his classroom for his canvas, his teaching methods for his brush, and his learning materials, even his students, for his paint. Finally, it may be pointed out that since under TAA teachers are not scientists, they are not bound by "empirical evidence" that certain of their techniques may be learning ineffective for their students. Aside from the issue of how learning effective a teacher's art may be for his students, it also risks becoming his self-centered use of other people's energy and time. For example, a teacher under TAA may so require his students to follow his art, that some of his students who would rather not learn under their teacher's "artistic" method may consider his teaching oppressive or even intellectually "suffocating."

While science aims at expressing reality subjectively, through the artistic creativity of the artist, science aims at expressing reality objectively, through the empirical investigations of the scientist. TAA is not any less expressive of reality than TAS, except the reality of TAA is the teacher's own, while the reality expressed by TAS is based, at least in part, on the students' observable behavior. Some examples of the scientific study of such "behavior" may include James Coleman's sociological study of the effect of social class on academic achievement, Jean Piaget's "psychological" study of cognitive development in children, and Philippe Aries' historical study of the behavior of adolescents in several western societies[19]. Implied in TAS is the idea that there is nothing that a teacher-as-artist does effectively that another teacher could not study objectively, or in turn apply in his teaching. By contrast, even the most learning-effective teacher may be seen under TAA as a "bad" artist, and therefore as a bad teacher. This means that while TAA may have immortal value as art, it is no more valuable as art in the fulfillment of learning goals, than a painting of a clear blue sky is in reversing the Greenhouse effect in the earth's atmosphere.

Although admittedly artists may reveal "truths" about human nature that can be revealed in no other way, or by no others, they may also feel the need to self-centeredly "use" others to better express their feelings. They may become so concerned with themselves, as they must be as artists, that they risk denying others their own "art," or, to paraphrase Jean Paul Sartre, their becoming artists-for-themselves[20]. This may be particularly true in situations where others may be forced by the circumstances to "depend" on the artist for guidance or leadership, as is clearly the case with students who have no choice but depend on their teacher for guidance[21]. This doesn't mean that all teachers who teach as if teaching were an art, or "teacher-artists," are insensitive to their students' own artistic needs, as there may be those whose teaching is so creative as to inspire students to new levels of unprecedented achievement. What it means is that the nature or "structure" of art-work itself is such as to lend itself easier to self-absorption, and therefore to possible lack of empathy for others[22].

On the other hand, if teaching were to become a science, what inclination a teacher may have to express his inner feelings or ideas, or to creatively

represent through his teaching example a new way of teaching, he must channel it within the boundaries established by the scientific method. A teacher with a new idea or image of how students learn can't propose it as a "fact" unless he has at least tested the "truth" of his assumptions empirically, or knows for a fact that someone else did. If he is bound by certain "rules of evidence," a teacher under TAS is not also discouraged from being creative or original. For example, he can't even begin to test ideas without at least some ideas to test. Consequently, he can be creative in the ideas that he proposes to test, for example, in formulating hypotheses for further testing, although not also in how selectively he can exclude certain facts that "disprove" his ideas.

Alternatively, if a scientist has new or original ideas, they must not only be tested empirically, but, unlike the view that an artist may have of the world, must be at least testable[23]. Thus while an artist can paint unicorns running in a field, or write a whole story full of imaginary characters, a scientist can't even say whether they exist, let alone describe what they do. Consequently, underlying TAS is the idea that however imaginative or creative educational theories may be, and there is no reason why they can't be, they must not only be tested, but also be fully testable.

If science lends itself easier to empirical observation of the world outside, it doesn't necessarily mean that no scientist risks ever replacing the world outside with ideas of his own[24]. If a scientist is less liable to doing so than an artist, that is, to replacing observable phenomena with ideas of his own, his is as "human" an interpretation as the artist's, and therefore as influenced by human thoughts and emotions as any human interpretation potentially can be. For example, a scientist may become so engrossed in his work, as to rarely see it objectively from a distance, or to examine critically its underlying scientific paradigm[25]. As a result, his attachment to science may become as strong a feeling for science, as the artist's presumably is for his art[26]. In fact, as a result of his scientific education, work in science, and emotional attachment to science, he may become unable to examine science critically, and thus end up using science to express his feelings, in this case, his feelings about science, rather than to understand the world "objectively" as-is. Seen from that angle, a scientist may be no different from the artist for whom his personal feelings or ideas are the starting point for his work. As a result of doing science without thinking critically about it, scientists risk practicing science as if it were a mechanical "technique," rather than a critical "praxis."[27]

We conclude from our discussion so far that whether a scientist can show logically that the scientific method is "superior" to another method of inquiry, the fact remains that practicing it uncritically is not the same as knowing why you practice it. What makes an "uncritical" scientist even more "biased" in this case than the artist is the fact that, unlike the artist who is at least aware of the subjective nature of his art, the scientist who practices science uncritically simply assumes that science is not "subjective." His "science" may become as powerful an emotion in his subconscious, as anything else which man does "blindly" as a result of "passion."[28] The irony here is that it may be impossible to show logically the superiority of the scientific method, or, more broadly, of "science," even if one were to examine it critically from a distance. It is to a brief examination of the logic of science that we turn to, next.

VIII. THE LOGIC OF SCIENCE

If a scientist attempts to "prove" the validity of the scientific method, he may find that it is an almost impossible task. Thus in his attempt to "test" experientially the "truth" of certain theories, he may be may be assuming the "truth" of an untested one through the means he employs to test it--namely, the theory that the scientific method itself is valid, or at least more valid than another method of inquiry[29]. If he attempts to test the "truth" or "validity" of the scientific method, then we can test it by using either the scientific method, or by some other means. If he uses the scientific method to test the validity of... the scientific method, then he would be assuming precisely that which he set out to prove, thus falling into a circular argument that proves nothing. If he uses another method, say, the "aesthetic method," then even if he can thus show that science is "true" or "valid," to be really true or valid he must also show that the method he used to test science (in our example, the "aesthetic method") is also valid[30]. Now if he uses still another method to test the validity of the aesthetic method, say the method of poetic intuition, then he must show that <u>that</u> method is also valid, which may lead him to choose another method to test the validity of the method of poetic intuition, and so on ad infinitum. There is no end to how many methods he must prove to be valid in order to show that the scientific method is valid, and therefore impossible to show that the scientific method is, indeed, valid.

Finally, even if it were possible for him to show through another, non-scientific method that science <u>is</u> valid, the fact that he did so through another method assumes that the other method is also valid. Such procedure is based on the assumption that the scientific method is not the <u>only</u> method that is valid. We conclude that faced with a choice between two equally "valid" methods, a scientific and a non-scientific one, there is no reason why anyone, including the individual teacher, should choose <u>only</u> the scientific method to test the validity of a learning theory. If he does, it may be because of what he perceives he can accomplish by using it, than because of anything inherently logically superior or "valid" in the scientific method itself.

IX. THE ROLE OF RULES

Rules <u>make</u> science, including the rule that nothing is "in fact" the case unless it is empirically verifiable; while in art, rules may become the subject of creative re-design by the artist[31]. It follows that under TAA, teachers are not only allowed more freedom to express their feelings than they are under TAS, but also more freedom to create their own rules of representation of feelings and ideas. For example, a teacher with particularly strong feelings regarding the creationism versus evolution controversy may re-arrange his teaching method and curriculum around his personal beliefs, or even make it a requirement that his students be able to identify his views in a test to pass in his class. By contrast, teachers under TAS can't arbitrarily replace scientific rules with rules of their own without possibly destroying precisely that which they are presumably advocating, namely, science itself.

On the other hand, it is not inconceivable that scientists change the rules of scientific inquiry to improve science. As means for the achievement of scientific goals, scientific rules of inquiry are no more necessary than are all

means as means, in general. To put it bluntly, they are what scientists think at the time can better serve scientific goals. If they change their rules of observation or experimentation, that doesn't necessarily mean that scientists have changed science itself, since their goals remain the same, but only what means they perceive will better serve their ultimate scientific goals. Thus while keeping constant their goal to describe (predict, understand) the world as-is, scientists may find ways which in their view will better help them achieve their goal[32]. Consequently, it is not inconceivable that if teachers under TAS change its rules, they are not arbitrarily replacing its rules with rules of their own, but simply trying to better achieve its overarching "scientific" goals.

If the rules in art are less clearly defined than rules in science, it doesn't mean that all art is great whatever its rules, or all activities that follow the scientific rules of inquiry are therefore good science. For example, I consider my drawings poor even if I follow certain pre-established rules regarding distance and perspective, while my friend creates better art even without following any. On the other hand, however unimaginative or outdated my experiments may be, they are at least scientific if I followed certain scientific rules, and therefore seen from a scientific perspective possibly "better" than unscientific experiments. Of course I may examine so trivial an educational issue in my research, that however well "controlled" or designed my experiment may be, it may be less interesting than an artistic approach even to teachers who would rather teach under the paradigm of TAS. We conclude that the difference between art and science, and by extension, between TAA and TAS, is not the presence or absence of rules, but how are such rules employed, respectively, to express inner feelings or ideas, or to "accurately" describe the world as-is.

## X. THE POLITICS OF TAA AND TAS

We examine the politics of TAS more extensively in another paper[33]. Suffice it to mention here that as educational paradigms for teaching practice, TAA and TAS are critical, respectively, of all un-artistic and un-scientific educational agendas. Thus to the extent that established educational agendas are unscientific or unartistic, whether now or in the future, to that extent TAS and TAA are "anti-establishment." Teaching under either TAA or TAS means that given a conflict between, say, Teaching-as-a-Moral-Exercise (TME), or Teaching-as-Tradition (TRA), on the one hand, and either TAS or TAA, on the other, a teacher chooses to sacrifice the former to the latter even if it means teaching under conditions that are neither "practical" nor politically "advantageous."

Given our society's emphasis on learning results, and the perceived ability of educational researchers to study objectively effective ways of improving such results, it is no wonder that TAS should be recognized by funding agencies as more important in the fulfillment of learning goals than TAA[34]. Of course if scientific proposals stand a better chance of being funded than artistic ones, that doesn't necessarily mean that this is so because schools themselves practice teaching as if it were a science, since, in fact, they may not[35], but simply that funding agencies prefer scientific over non-scientific proposals.

Finally, it may be noted that if researchers must conform to certain rules of scientific inquiry under TAS, or teachers have an ethical obligation to consider in good faith the results of educational research, it doesn't

necessarily mean that they must conform politically to the educational status quo to survive. In fact, a teacher or researcher under TAS may introduce evidence or "facts" that discredit the dominant educational paradigm, and therefore become "subversive." This may explain why it is so difficult to conduct educational research outside the parameters established by the public school system, or why research done outside such system may be seen by teachers or school administrators as being "inapplicable."[36]

XI. CONCLUSION

Is teaching an art or a science? We could argue that teaching is, quite simply, both art and science, as are all human activities, and leave it at that. We are not satisfied with such easy solution, since it tells us nothing about how much of each teaching is, and exactly how the two are combined in teaching practice. Whether teaching is an art or science depends on which definition of teaching we adopt, or what we think the goals of teaching should be. If, for the sake of argument, we mean by teaching the attempt to help our students learn, then teaching may be seen as the art of applying learning research. Ironically, in spite our use of the term "art" here, trying to help students learn based on how we have observed them in fact learn makes teaching more a science than an art, and therefore more the "art" of induction from facts, as in science, than the "science" of deduction from feelings, as in art. If, on the other hand, we mean by teaching simply the act of conveying information with no particular emphasis on how well students learn, then teaching lends itself easier to a teacher expressing his feelings even spite his learning effectiveness, and therefore to TAA.

The fact that man has art means that even under the paradigm of TAS he must acknowledge his art: a scientific observation of man requires that he acknowledge his artistic creativity. Alternatively, even arti-facts are in-fact "facts," and therefore require that the artist has at least some knowledge of the world to create them. In his effort to communicate with others, the artist is "forced" to learn enough about the "world" to be able to recreate "objectively" his personal dream or vision. This means that if a teacher is teaching as if he were an artist, then he may still have to learn enough about his students, for example, their patterns of learning, thinking, or feeling, or about his colleagues or school system, to be able to recreate objectively in his classroom his personal vision of teaching.

If a teacher-as-artist is not satisfied with simply how he can recreate objectively in his teaching his own view of teaching, but also wants his students to learn, then he may have to use his art to serve his students, rather than his students to serve his art. It is in this sense that "effective" teaching is both a science and an art, since it can be artistic enough to allow teacher-initiated creativity to intervene, if not require it at least in the formulation of learning hypotheses, but not so artistic as to sacrifice learning by students to his inner subjectivity.

In this paper we tried not so much to offer a prescription of how one should teach, but by distinguishing between art and science to lay open some of the underlying assumptions in both TAA and TAS. Whether one decides to teach as one or the other may depend as much on his overall educational or teaching goals,

as on his definition of teaching.

ENDNOTES

[1]For a discussion of systems building in philosophy of education see G. Max Wingo, Philosophies of Education: An Introduction, 2nd edition (Lexington, Mass.: D. C. Heath, 1974).

[2]Plato, The Phaedo, Theaetetus, The Republic, in The Dialogues of Plato, tr. Benjamin Jowett (Oxford: Oxford University Press, 1953).

[3]On John Dewey's view of the scientific method, see Dewey, The Sources of a Science of Education (New York: Liveright: 1929); How We Think (Boston: D. C. Heath, 1933); The Quest for Certainty (New York: Minton, Balch, 1929); Intelligence in the Modern World, ed. Joseph Ratner (New York: The Modern Library, 1939); Democracy and Education (New York: The Free Press, 1966); The Child and the Curriculum (Chicago: University of Chicago Press, 1902).

[4]See Susanne Langer, Philosophy in a New Key (Cambridge, Mass.: Harvard University Press, 1942); Ernst Cassirer, The Philosophy of Symbolic Forms, tr. Ralph Manheim (New Haven, Conn.: Yale University Press, 1953-57).

[5]On religion and society in the Middle Ages, see Geoffrey Barraclough, ed., Eastern and Western Europe in the Middle Ages (New York: Harcourt, Brace, Jovanovich, 1970); Thomas F. X. Noble, and John J. Contreni, ed., Religion, Culture and Society in the Middle Ages (Kalamazoo, Mich.: Medieval Institute Publications, Western Michigan University, 1987).

[6]The relation of culture to personality has been a favorite topic of writers since classical times. See, for example, Plato, The Republic, in The Dialogues; Sigmund Freud, Civilization and Its Discontents, tr. James Strachey (New York: Norton, 1961); Wilhelm Reich, The Mass Psychology of Fascism, tr. V. R. Carfagno (New York: Farrar, Straus, and Giroux, 1970); Herbert Marcuse, Eros and Civilization (Boston: Beacon Press, 1966); Albert Memmi, Dominated Man (Boston: Beacon Press, 1969).

[7]For example, in the field of psychology alone different views on teaching may be inferred from psychoanalytic, humanistic, behavioristic, or existentialistic theories. See Calvin S. Hall and Gardner Lindzey, Theories of Personality (New York: John Wiley, 1978). Likewise with different schools of thought, or their representative thinkers in the fields of anthropology, sociology, history, or philosophy.

[8]On the existentialist view of teaching, see the relevant chapter in Wingo, Philosophies of Education; George F. Kneller, Existentialism and Education (New York: Wiley, 1958); and Van Cleve Morris, Existentialism in Education (New York: Harper and Row, 1966). On Dewey's views on teaching, see Dewey, School and Society (Chicago: University of Chicago Press, 1943); Democracy and Education; Child and the Curriculum (Chicago: University of Chicago Press, 1956); My Pedagogic Creed (Chicago: Flanagan, 1910); Experience and Education (New York: Collier Books, 1969); Interest and Effort in Education (Boston: H. Mifflin, 1913). On Plato's view see The Meno, The Symposium, The Republic, The Laws, and the Phaedo, in The Dialogues.

[9]There are probably as many views of teaching as there are public or representative "education groups." See, for example, the views expressed during the school reform movement in Chicago in 1988 and 1989 by the various popular reform groups, such as, Citizens Schools Committee, The Concerned Parents' Network, Taxpayers for Responsible Urban Education (T.R.U.E.), Reconstruct Education with Students, Parents, Educators and Community Together (R.E.S.P.E.C.T.), and others.

[10]On the use of "personal dictionaries" in scientific terminology see, among others, N. R. Campbell, What is Science? (New York: Dover, 1952).

[11]On the mixed artistic-scientific view of teaching see Dewey, Sources of a Science of Education; Nathaniel L. Gage, Hard Gains in the Soft Sciences: The Case of Pedagogy (Bloomington, Ind.: Phi Delta Kappa Center on Evaluation, Development and Research, 1985); The Scientific Basis of the Art of Teaching (New York: Teachers College Press, 1978).

[12]These "definitions" of art and science are derived from the author's reading of works in the history of art and science, his personal encounters with works of art and science, and his own re-interpretation of these theories. The works written in the philosophy of science and the philosophy of art are too numerous to include here. Instead, only a few "classics" and introductory works are mentioned. In the area of the **philosophy of science**, see Plato, Phaedo, in Jowett, Dialogues; Aristotle, Analytica Posteriora, in J. A. Smith and W. D. Ross, eds., Works, 12 vols. (Oxford: Oxford University Press, 1910-1952), vol. I; Rene Descartes, Discourse on Method, tr. Paul Oscamp (Indianapolis: Bobbs

Merrill, 1965); Issac Newton, Mathematical Principles of Natural Philosophy, tr. A. Motte (Chicago: Encyclopedia Britannica, 1955); Ernest Nagel, The Structure of Science (New York: Harcourt Brace, 1961); Richard B. Braithwaite, Scientific Explanation: A Study of the Function of Theory, Probability and Law in Science (Cambridge, England: University Press, 1953); Herbert Feigl and May Brodbeck, eds., Current Issues in the Philosophy of Science (New York: Holt, Rinehart & Winston, 1961); Norwood R. Hanson, Patterns of Discovery (Cambridge, England: University Press, 1965); Thomas S. Kuhn, The Essential Tension: Selected Studies in Scientific Tradition and Change (Chicago: University of Chicago Press, 1977); Kuhn, The Structure of Scientific Revolutions (Chicago: University of Chicago Press, 1962); Carl G. Hempel, Aspects of Scientific Explanation and Other Essays in the Philosophy of Science (New York: Free Press, 1965); Stephen Toulmin, The Philosophy of Science: An Introduction (London: Hutchinson, 1953); Paul K. Feyerabend, and Grover Maxwell, eds. Mind, Matter, and Method: Essays in Philosophy and Science in Honour of Herbert Feigl (Minneapolis: University of Minnesota Press, 1966); John Ziman, An Introduction to Science Studies: The Philosophical and Social Aspects of Science and Technology (Cambridge, England: University Press, 1984); Harry S. Broudy, Robert H. Ennis, and L. I. Krimerman, eds., Philosophy of Educational Research (New York: John Wiley, 1973). There seems to be much less agreement on **what is art**, than on what is science in the philosophical literature. In any event, given the variety of often conflicting philosophical theories, the reader may non-philosophical literature, for example, historical, autobiographical, sociological, psychological, or anthropological works on art, at least as helpful. See Joseph Margolis, Philosophy Looks at the Arts (Philadelphia, Pa.: Temple University Press, 1978); Ernst Cassirer, Philosophy of Symbolic Forms (New Haven, Conn.: Yale University Press, 1953-57); Suzanne Langer, Philosophy in a New Key (Cambridge, Mass.: Harvard University Press, 1942); Monroe C. Beardsley and Herbert M. Schneller, eds., Aesthetic Inquiry: Essays on Art Criticism and the Philosophy of Art (Belmont, Ca.: Dickenson, 1967); Robert Goldwater and Marco Treves, eds., Artists on Art, from the XIV to the XX Century (New York: Harper and Row: 1945); John Dewey, Art as Experience (New York: Minton, Balch, 1934); Albert Hofstadter and Richard Kuhns, eds., Philosophies of Art and Beauty (New York: Modern Library, 1964); Robin G. Collingwood, The Principles of Art (Oxford: Clarendon Press, 1938); John Hospers, ed., Artistic Expression (New York: Appleton-Century-Crofts, 1971); R. Layton, The Anthropology of Art (New York: Columbia University Press, 1981); Evelyn Payne Hatcher, Art as Culture: An Introduction to the Anthropology of Art (Lanham, MD: University Press of America, 1985); Charlotte M. Otten, ed., Anthropology and Art (Garden City, N.Y.: Natural History Press, 1971).

[13]This is in response to several arguments made regarding the dangers of technological control, or the elimination of humanistic studies in education. This view was most clearly expressed during the 1990 conference of the Midwest Philosophy of Education Society in Chicago by Professor Harry S. Broudy in his "Comments on Popp and Noel." Annual Conference of the Midwest Philosophy of Education Society, Chicago, Illinois, Nov. 9, 1990 (see inside Proceedings).

[14]Ralph M. Blake, Curt J. Ducasse, and Edward H. Madden, Theories of Scientific Method: THe Renaissance through the Nineteenth Century (Seattle: University of Washington Press, 1960).

[15]John Dewey, Democracy and Education.

[16]Dewey, Sources of a Science of Education.

[17]Dewey, Sources, "Education as an Art," p. 13.

[18]On symbolism in art, see Ernst Cassirer, Philosophy of Symbolic Forms, tr. Ralph Manheim (New Haven, Conn.: Yale University Press, 1955-1957); and Suzanne K. Langer, Feeling and Form (New York: Scribner's, 1953).

[19]James Coleman, et. al., Equality of Educational Opportunity (Washington, D.C.: U.S. Government Printing Office, 1966); Jean Piaget, The Origins of Intelligence in Children (New York: International University Press, 1952); Philippe Aries, Centuries of Childhood (New York: Knopf, 1962).

[20] Jean Paul Sartre, Being and Nothingness, tr. Hazel E. Barnes (New York: Philosophical Library, 1956).

[21]On the teacher-student relation, see Willard Waller, The Sociology of Teaching (New York: Wiley, 1932); Robert Dreeben, On What Is Learned in School (Reading, Mass.: Addison-Wesley, 1968). Several writers have written critically about several aspects of schooling, including a group of educational historians known as the "revisionists." See, for example, Colin Greer, The Great School Legend: A Revisionist Interpretation of American Public Education (New York: Basic Books, 1972); Walter Feinberg, Reason and Rhetoric (New York: Wiley, 1975); and Michael Katz, Class, Bureaucracy and Schools: The Illusion of Educational Change in America (New York: Praeger, 1975). Finally, there is a group of writers who have been critical of schooling as a whole. See, for example, Ivan Illich, Deschooling Society (New York: Harper and Row, 1970).

[22]Several works have been published in recent decades on the effect of "structure" on behavior and personality development. See Jean Piaget, Structuralism, tr. and ed. C. Maschler (New York: Basic Books, 1970).

[23]On the "testability" of theories or ideas in science, see Rudolf Carnap, "Testability and Meaning," Philosophy of Science, vol. 3 (1936), 419-471, and vol. 4 (1937), 1-40; and Ernest Nagel, The Structure of Science.

[24]On the role of "theory" or "paradigm" in science, see Michael Scriven, "Definitions, Explanations and Theories," in Minnesota Studies in the Philosophy of Science, Vol. II, Herbert Feigl, Michael Scriven, and Grover Maxwell, eds. (Minneapolis: University of Minnesota Press, 1958), pp. 99-195; Thomas S. Kuhn, The Structure of Scientific Revolutions; and Norwood R. Hanson, Observation and Explanation (New York: Harper & Row, 1971).

[25]Recognizing the danger of such "biased" interpretation of reality, Edmund Husserl suggested that a scientist put his personal beliefs in "brackets" during his observation of phenomena. See Husserl, Phenomenology and the Foundations of the Sciences, tr. T. E. Klein and W. E. Pohl (Boston: M. Nijhoff Publishers, 1980).

[26]The effect of scientific education on scientists is graphically portrayed in Kuhn's The Structure of Scientific Revolutions.

[27]I am referring here to Paulo Freire's distinction between mechanical action that requires no critical thinking on the actor's part, or "technique," and one which assumes a critical or "thoughtful" view of reality, or "praxis." See Freire, Pedagogy of the Oppressed, tr. M. B. Ramos (New York: Continuum, 1985).

[28]There are several social-psychoanalytic interpretations of how certain experiences may be eventually "internalized," which in turn may cause the person to act "irrationally." See, for example, Sigmund Freud's classic description of internalization in The Ego and the Id, tr. Strachey (New York: Norton, 1960); See also Freud, Totem and Taboo, tr. James Strachey (New York: Norton, 1950); and The Future of an Illusion, tr. W.D. Robson-Scott (Garden City, N.Y.: Doubleday, 1957).

[29]On the logic of scientific inquiry, in general, see, among other works, Karl Popper, The Logic of Scientific Discovery; Carl G. Hempel and Paul Oppenheim, "The Logic of Explanation," in Herbert Feigl and May Brodbeck, eds., Readings in the Philosophy of Science (New York: Appleton-Century-Crofts, 1953), pp. 319-352.

[30]We use the "aesthetic method" only for illustration purposes here. We shall define this method of inquiry as a method that assumes that something is "true" if it is "beautiful."

[31]On the role of rules in science, see, among others, C. F. Presley, "Laws and Theories in the Physical Sciences," in Arthur C. Danto and Sidney Morgenbesser, eds., Philosophy of Science (New York: Meridian Books, 1960), pp. 205-215.

[32]Unlike Kuhn, who assumed in The Structure of Scientific Revolutions that science has undergone several "revolutions," we submit that it has simply improved its methods of observation. A "revolution" implies a radical change in goals, which never really happened in science. We sumbit that even based on the examples that Kuhn mentioned in his book, what changed were not the goals of science, in the sense of science as the attempt to understand the world, but its intervening "means." Consequently, such changes may better be seen not as "revolutions," but simply as "improvements." This is not to deny the tremendous contribution which Kuhn made to the philosophy of science, if for no other reason because of the discussion that it caused, but simply to distinguish between "essential" and "instrumental" changes, and therefore between scientific revolutions, and simply scientitifc improvements.

[33]A. Makedon, "The Politics of Teaching as a Science." Paper presented in November of 1989 at the Annual Convention of the American Educational Sudies Association (AESA), Chicago, Illinois, in November of 1989. A chapter by that title is also included in a book on "Teaching as a Science" that is presently being prepared by the author.

[34]This is shown from the number of scientific proposals being funded for research, and the criteria for funding established by funding agencies. For a discussion of the politics of funding for research, see Robert Glaser, ed., Research and Development and School Change (Hillsdale, NJ: Halsted Press/J. Wiley, 1978); and Walter R. Borg and Meredith D. Gall, Educational Research (New York: Logman, 1989).

[35]As Jack L. Nelson and James P. Shaver put it regarding the relation of empirical research to the teaching of social studies, "... there is a great void. Practice seems virtually undisturbed by research. .. educational and social policy is apparently uninformed by research and remains bound to moralism and prior practice." In William B. Stanley, et. al., Review of Research in Social Studies Education, 1976-1983 (Boulder, Colo.: ERIC Clearinghouse for Social Studies/Social Science Education: Social Science Education Consortium; Washington, D.C.: National Council for the Social Studies, 1985), p. 420. See also Makedon, "Politics of Teaching as a Science."

[36] According to Ralph W. Tyler, practitioners pay no attention to research that is not "consistent" with the reality that they perceive. Tyler, "How Schools Utilize Educational Research and Development," in Glaser, ed., Research and Development and School Change, p. 97.